

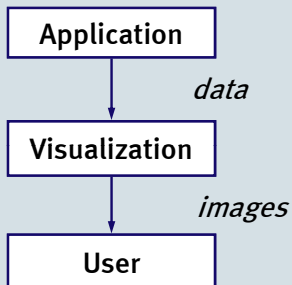
Visualization of Software

Jack van Wijk

Plenary Meeting SPIDER
Den Bosch, March 30, 2010

Overview

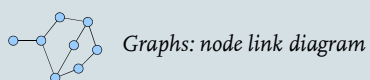
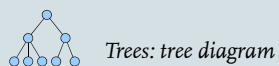
- Software Vis
- Examples
 - Hierarchies
 - Networks
 - Evolution
- Visual Analytics



Information Visualization

- The use of computer-supported, **interactive, visual** representations of **abstract data** to **amplify cognition** (Card *et al.*, 1999)

Abstract data



InfoVis at TU/e

- Large data sets, professional users
- Explorative
- Use of computer graphics know-how
 - shading, geometry, texture, ...
- Software Visualization

Software Visualization

- User: developer, architect, manager, ...
- Some questions:
 - Is the structure sound?
 - Can I improve the structure by refactoring?
 - What has happened with the system?
 - Does the implementation conform the architecture?
 - Where are the weak spots?

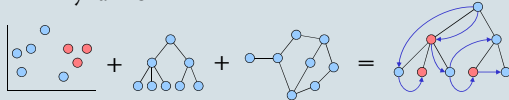
Cooperations

- LaQuSo: Laboratory for Quality Software TU/e
- TU Delft, Arie van Deursen
- Tiobe, Eindhoven
- SolidSource, Eindhoven

Challenges

Combination of **large amounts of**

- Multivariate data (metrics)
- Hierarchical data (system, subsystem, module, ..)
- Graph data (call relations)
- Text (names, code)
- Dynamic



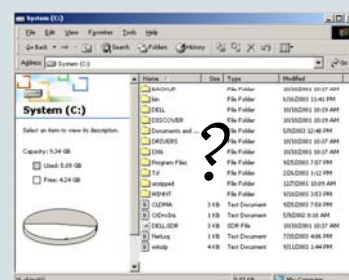
Challenges: Different views

- Architecture
 - System structure; data; coordination, temporal aspects
- Code
 - Structure; derived data, metrics; evolution
- Execution
 - Traces, call graphs

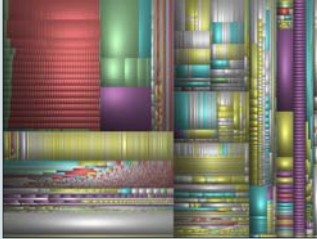
Examples

- Cushion Treemaps (trees)
- Beamtrees (trees)
- Botanic vis (trees)
- MatrixView (tree + graph)
- Hierarchical Edge Bundles (tree + graph)
- CVSScan (code evolution)

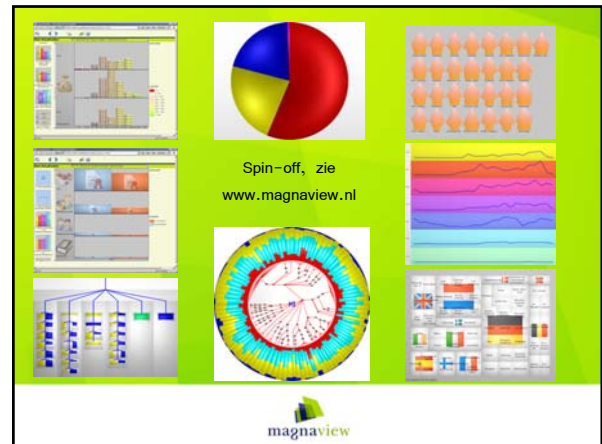
Why is my hard disk full?



Demo SequoiaView



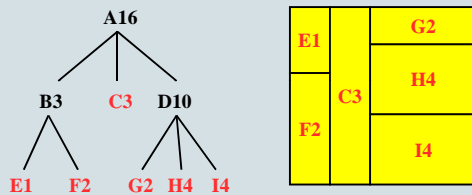
- www.win.tue.nl/sequoiaview



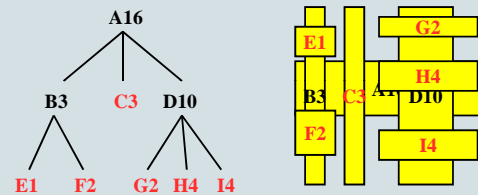
Spin-off, zie
www.magnaview.nl

magnaview

Treemap (Shneiderman, 1992)

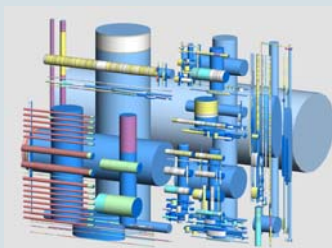


Beamtree



Frank van Ham

Demo Beamtree



Botanical visualization of large tree structures

Botanical trees are easy to understand.

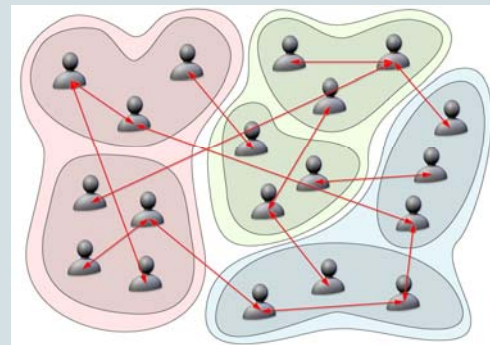
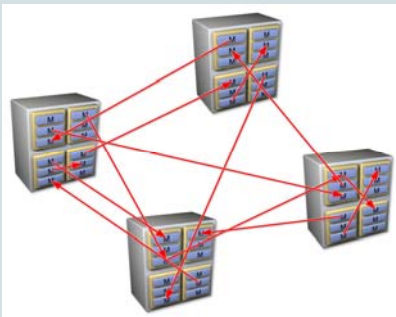
How to use this for InfoVis? What happens when we map folders to branches and files to leaves?

Ernst Kleiberg

Demo TreeView



Trees + graphs



Tree + graph

Problem: visualize a **hierarchy** of items and **relations** between those items

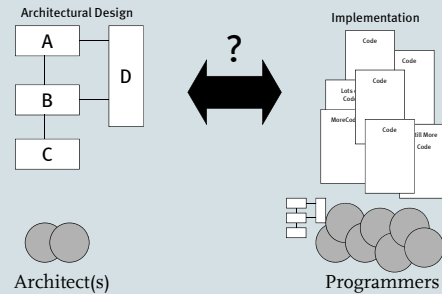


Complete Data	Hierarchy	Additional Relations
Software system	Modules	Calls
Social network	Groups of people	Acquaintances
Citation network	Articles	Citations
Meta-data network	Keywords	Keyword relations

MatrixView

- Frank van Ham

Conformance design/implementation



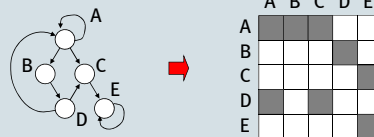
MatrixView

Data:

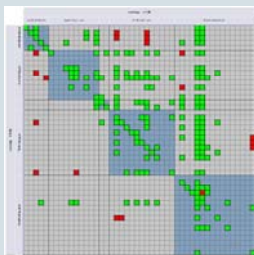
- hierarchy of layers, units, modules, classes, methods
- methods calling each other

MatrixView

Matrix representation of graph



Demo MatrixView



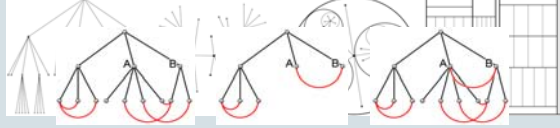
Hierarchical Edge Bundles

- Danny Holten
- Again, tree+graph, but now completely different

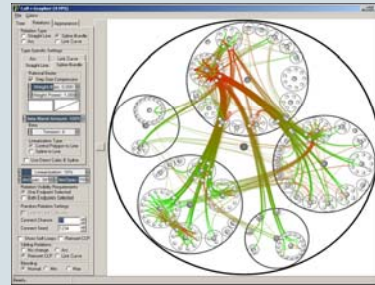
Visualization Challenge

Visualize **relations** on top of **hierarchy** in such a way that:

- **Visual clutter** is decreased
- Technique can be used for **any tree** visualization
- **Low- and high-level** relations can be shown simultaneously



Demo Call-i-Grapher

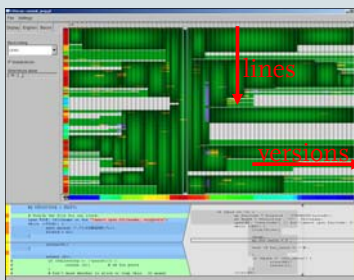


Hierarchical Edge Bundles

- Best paper IEEE InfoVis 2006
- Used by LaQuSo
- Integrated in many libraries and tools
- Spin-off starting up

CVSScan

- Visualization of code evolution
- Challenge: visualize contents of large software version control repositories
- Lucian Voinea, supervised by Alex Telea



Demo CVSScan

Information Visualization

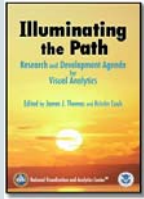
Information visualization:

- + Large data sets
- + Visual presentation
- + Interaction

Data analysis:

- Heterogenous data
- Collaboration
- Automated analysis
- From raw data to presentation

Visual Analytics



- Founder: Jim Thomas, NVAC
- *Illuminating the Path*, 2004

Visual Analytics:

- *The science of analytical reasoning facilitated by interactive visual interfaces*

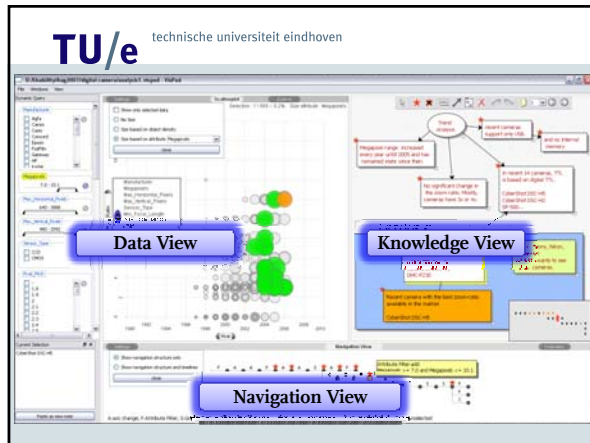
Support for Sensemaking

Data View
offers interactive information visualization tools.

Knowledge View
helps to record findings and causal links between them.

Navigation View
provides overview of the exploration process by capturing visualization states automatically.

Yedendra Shrinivasan, CHI 2008



Conclusion

- Examples of software visualization
- Challenging area still...